

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 82328E	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/FI2005/000145	International filing date ( <i>day/month/year</i> ) 09 March 2005 (09.03.2005)	Priority date ( <i>day/month/year</i> ) 09 March 2004 (09.03.2004)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant CANATU OY			

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- |                                     |              |   |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the report   |
| <input type="checkbox"/>            | Box No. II   | Priority  |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention  |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input checked="" type="checkbox"/> | Box No. VI   | Certain documents cited   |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application  |
| <input type="checkbox"/>            | Box No. VIII | Certain observations on the international application   |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

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The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. +41 22 338 82 70	Date of issuance of this report 13 September 2006 (13.09.2006)
	Authorized officer  <b>Beate Giffo-Schmitt</b>  e-mail: pt03@wipo.int

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

P103

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## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/FI2005/000145

International filing date (day/month/year)  
09.03.2005

Priority date (day/month/year)  
09.03.2004

International Patent Classification (IPC) or both national classification and IPC  
C01B31/02

Applicant  
CANATU OY

### 1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

### 3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/FI2005/000145

**Box No. I Basis of the opinion**

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material:
    - ☐ in written format
    - ☐ in computer readable form
  - c. time of filing/furnishing:
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in computer readable form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/FI2005/000145

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**Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	9,14,20,27-39,43
	No: Claims	1-8,10-13,15-19,21-26,40-42,44-54
Inventive step (IS)	Yes: Claims	27-31,33-34
	No: Claims	1-26,32,35-54
Industrial applicability (IA)	Yes: Claims	1-54
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

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**Box No. VI Certain documents cited**

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**1. Certain published documents (Rules 43*bis*.1 and 70.10)**

and / or

**2. Non-written disclosures (Rules 43*bis*.1 and 70.9)**

**see form 210**

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**Re Item V.**

1. Reference is made to the following documents:

D1 : WO 02/076887 A (NATIONAL RESEARCH COUNCIL OF CANADA; SIMARD, BENOIT; BARNETT, MICHAEL;) 3 October 2002 (2002-10-03)

D2 : US 2002/102203 A1 (SMALLEY RICHARD E ET AL) 1 August 2002 (2002-08-01)

- 2 Document D1 discloses (the references in parentheses applying to this document): a process for preparing carbon nanotubes comprising laser ablating a bulk metal catalyst in a hydrocarbon solution to produce a feedstock containing metal catalyst nanoparticles. The feedstock is then atomized to form an aerosol which is heated to decompose the hydrocarbon to carbon nanotubes (page 3, lines 12-27). This method allows a control of the parameters which influence the structure of the resulting carbon nanotubes (page 4, lines 12-17, page 8, line 20-page 9, line 12). The catalyst nanoparticles are formed before the carbon nanotube synthesis reaction in a small cell close to the aerosol nozzle so as to allow a continuous process (page 7, second line from the bottom- page 8, line 6). A filter may be included in the apparatus in order to classify the particles (page 9, lines 21-24).

**2.1 INDEPENDENT CLAIM 1**

As can be seen from the above, document D1 discloses in combination all the features defined in independent claim 1. Hence the subject-matter of this claim is not new (Article 33(2) PCT).

**2.2 INDEPENDENT CLAIM 40**

As can be seen from the above, document D1 discloses in combination all the features defined in independent claim 40. Hence the subject-matter of this claim is not new (Article 33(2) PCT).

**2.3 INDEPENDENT CLAIM 48**

The utilization of carbon nanotubes for materials and devices is well known in the state of the art (page 1, first paragraph of "Background of the invention"). The subject-matter of claim 48 is therefore not novel (Art. 33(2) PCT).

- 3 Document D2 discloses (the references in parentheses applying to this document): a method for preparing single-walled carbon nanotubes by creating an aerosol of seed molecules, mixing it with a catalyst stream and a carbon feedstock and reacting to form carbon nanotubes ([0085]-[086]). The catalyst stream may be made of catalyst particles dispersed in a fluid which, in one embodiment of the invention ([0098]), is injected together with the seed molecules as aerosol into the reactor where the nanotubes grow. The metal catalyst particles can be formed by laser heating catalyst precursor molecules. The result is a population of single-walled carbon nanotubes suspended in the mixed gas stream ([0096]). The invention allows a high control of the product ([0102]). The seed molecules, which remain part of the final structure ([0018]), are chosen from the family of fullerene and carbon nanotubes derivatives ([0087]-[0088]). The nanotubes obtained are used in a number of applications ([0103]).

**3.1 INDEPENDENT CLAIM 1**

As can be seen from the above, document D2 discloses in combination all the features defined in independent claim 1. Hence the subject-matter of this claim is not new (Article 33(2) PCT).

**3.2 INDEPENDENT CLAIM 40**

As can be seen from the above, document D2 discloses in combination all the features defined in independent claim 40. Hence the subject-matter of this claim is not new (Article 33(2) PCT).

**3.3 INDEPENDENT CLAIM 48**

As can be seen from the above, document D2 discloses in combination all the features defined in independent claim 48. Hence the subject-matter of this claim is not new (Article 33(2) PCT).

**4 DEPENDENT CLAIMS 2-26, 32, 35-39, 43, 44, 46, 47, 50-52, 54**

Dependent claims 2-26, 32, 35-39, 43, 44, 46, 47, 50-52, 54 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

**5 DEPENDENT CLAIMS 27-31, 33-34**

The combination of the features of dependent claims 27-31, 33-34 are neither known from, nor rendered obvious by, the available prior art. The reasons are as follows: in none of the documents cited in the international search report the formation of catalyst particles using a hot wire generator is disclosed (Novelty, Art. 33(2) PCT). This method has the advantage of producing a large number of small metal clusters with an exceptionally narrow particle size distribution (page 15, lines 20-27). As the size of the catalyst particles are known to be responsible for the diameter of the synthesized carbon nanotubes, this method allows to obtain carbon nanotube samples having a narrow distribution of diameters (Inventive step, Art. 33(3) PCT).

**6 Since the subject-matter of each of independent claims 41, 42, 45, 49, 53 corresponds to the subject matter of at least one of claims 1, 40, 48, the same reasoning as given for claims 1, 40, 48 will apply mutatis mutandis.**

Therefore claims 41, 42, 45, 49, 53 also do not meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).